

*Try These Methods for a Successful Cover Crop
Ahead of Soybeans*



Considerations for First Time Cover Crop Adopters

By Dr. Shalamar Armstrong, Lowell Gentry, Dan Schaefer, Eric Miller and John Pike

Edited by Jean Payne

A publication of the Illinois Nutrient Research & Education Council



The observations in this guidance document are based on multi-year Nutrient Research and Education Council (NREC) funded research projects. The authors are the principal investigators and participants in the research. NREC continues to evaluate the establishment, management and results of cover crops at on-farm, field scale trials in corn/corn, corn/soy, and corn/soy/wheat rotations.

** For questions or assistance regarding the guidance provided in this document, please contact:*

Dr. Shalamar Armstrong is Assistant Professor of Agronomy at Purdue University. Dr. Armstrong is the principal investigator at McLean County NREC site. sarmstrong@purdue.edu

Lowell Gentry is Principal Research Specialist in Agriculture, University of Illinois. Lowell is the principal investigator at Piatt, Douglas and Champaign County research sites. lgentry@illinois.edu

Dan Schaefer is Director of Nutrient Stewardship, IL Fertilizer & Chemical Association. Dan assists in coordination of research work at Piatt, Douglas and Champaign County sites. dan@ifca.com

Eric Miller is an Illinois producer. Eric participates in on-farm research at his farm in Piatt County and assists in facilitating activities at the Douglas County research site. eric@mappingsolutionsgis.com

John Pike is an agronomist and owns Pike Ag Consulting LLC. John was involved in NREC funded University of Illinois cover crop treatments at Dixon Springs, IL and assists NREC with this and other projects in Southern Illinois. jpik1.ag@gmail.com; (618) 727-1234

Jean Payne is President of the Illinois Fertilizer & Chemical Association. jeanp@ifca.com

The Illinois Nutrient Research & Education Council (NREC) was created by state statute and is funded by a 75-cent per ton assessment on bulk fertilizer sold in Illinois. NREC supports nutrient research and education programs to ensure the discovery and adoption of practices that address environmental concerns, optimize nutrient use efficiency, and ensure soil fertility. More information can be found at www.illinoisnrec.org.

Why Consider a Cover Crop Ahead of Soybeans?

Preventing soil erosion and reducing nutrient losses are two benefits of cover crops. In NREC projects, these benefits have proven to be repeatable, with a comfortable level of certainty. With four years of in-field research on Illinois farms to draw upon, the studies indicate a nitrate load reduction in field tile can be as high as 60% when cover crops follow corn, compared to fields with no cover crop. These studies have shown no detrimental impact on the soybean crop that follows the cover crop.

So, if you want to try a cover crop for the first time, try it ahead of soybeans, not corn. The risk associated with adoption before soybeans is considerably lower, relative to adopting ahead of corn. We will take you through the steps that can help provide a successful experience based upon research results.

What Cover Crops Should You Consider?

- For the simplest approach, a farmer incorporating cover crops for the first time should consider species that winter kill. While this won't provide as much nutrient sequestration as cover crops that resume growth in the spring, it will help you develop a comfort level with seeing "green fields" in the fall. Oats or an oat/radish blend is a good fit for this purpose. Quality seed is readily available at a reasonable cost. Establishment should occur in September to achieve adequate growth and results. Termination occurs naturally when nighttime temperatures fall to the teens.
- For those comfortable trying a winter tolerant cover crop, consider cereal rye (occasionally called winter rye). This is a common cover crop in the Midwest due to ease of establishment (even under very cool soil temperatures), and it is a strong nitrogen scavenger in both fall and spring. The seed is also readily available. Note: Cereal rye is not the same as annual ryegrass.

The Cover Crop Selector Tool at mccc.msu.edu/covercroptool/covercroptool.php is a resource that enables you to select your state and county, as well as soil characteristics, to help you determine the most suitable cover crop to achieve your desired goals.



Midwest Cover Crops Council - Cover Crop Decision Tool
Illinois: La Salle County Seeding Dates

Location Information: Illinois | La Salle

Cover Crop: Soybeans | Plant Date: 08/01/2018 | Harvest Date: 10/10/2018

Drainage Information: Moderately Well Drained | Flooding: No

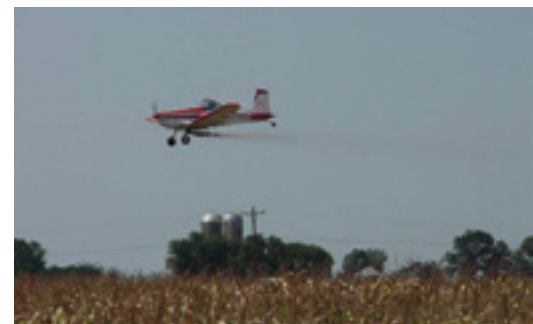
Goal #1: Nitrogen Scavenger | Goal #2: Erosion Fighter | Goal #3: Soil Builder

Now let's consider steps for incorporating a cereal rye cover crop in the fall after corn and ahead of soybeans. *We strongly encourage you to select a small field, or a portion of a larger one for your first-year trial.* (When the considerations outlined below are followed, findings from NREC projects show no negative impact on soybean establishment or yields following cereal rye).

1. **Herbicides:** Determine the field's corn herbicide program history to ensure it is compatible with the seeding of cereal rye. An internet search of "herbicide rotation restrictions and cover crops", plus a discussion with your crop adviser are beneficial. Several common corn herbicides have a four month or less restriction, but some can exceed this. Dry summer conditions may also slow degradation of some residuals and late applied post products. If carryover concern exists, hand seed and water a few square foot area a couple weeks before your anticipated planting date and evaluate the growth. Also, be mindful that you cannot make a fall herbicide application to control winter annuals if you want to establish a cover crop. Consider the lessons learned from the article in this link: ag.purdue.edu/btny/weedscience/Documents/covercropcarryover.pdf
2. **Planting Date:** You can plant cereal rye from early September through the first week of November. Typical corn harvest dates are quite compatible with this schedule. Unincorporated surface applications of seed should cease by the later portion of October.
3. **Residue Distribution:** It's often said, "A growing season starts with the residue coming out the back of the combine." Properly sized residue that is evenly spread the full width of the area being harvested creates uniform field conditions. A mat of residue next to a strip of bare ground will make all aspects of management more difficult, whether it is establishing a cover crop, or the cash crop to follow.
4. **Planting Methods:** Several techniques can be used to establish cereal rye. Planting/incorporating methods generally produce more uniform, predictable stands compared to aerial/surface applications. Let's review the most common planting options:



Even corn residue distribution



Aerial seeding in standing corn



High clearance seeding

PRE-HARVEST SEEDING:

Aerial application- Skilled pilots can uniformly broadcast cereal rye into standing corn. The seed will make contact with the soil before residue is deposited from corn harvest. Best results have been when soil is damp and a substantial rain is likely. *"If it's dry, don't fly. If it's wet, you bet."*

High Clearance Applicator- You can also apply cover crops into standing corn with a high clearance applicator equipped with a cover crop seeder.

POST HARVEST SEEDING:

Surface Application- If you uniformly fertilize the field (no variable rates), cereal rye can be blended with dry fertilizer. A light vertical tillage pass may need to be considered, as surface residue can interfere with seed-to-soil contact.

Plant/drill- A no-till drill will generally produce a uniform, quick emerging stand. Research has also shown 15” planters with row cleaners and the correct seed disc/plate can perform very well. A corn head that sizes stalks will help with material flow during these operations. A vertical tillage pass and then drill/planter pass can also be effective. Labor and machine costs need to be a consideration with these practices.

Aerial Application- This establishment method can still be considered. But to increase the success with this scenario, a light vertical tillage pass should be considered, because surface residue can interfere with seed-to-soil contact. Again, any surface application should cease by the last several days of October.

Note: For soil conservation, consider vertical-till, no-till, or strip-till planting methods for soybeans; tillage considerations will be discussed later in this document.

5. **Seeding Rate:** Use this table as a guide to determine the appropriate cereal rye seeding rate based upon your choice of seeding method.

Drilled Seeding Rate:	50-90 lb./A
Broadcast Seeding Rate:	58-104 lb./A
Aerial Seeding Rate:	60-108 lb./A
Seed Count:	18,000 Seeds/lb

We advise new cover crop adopters to start with modest seeding rates; they help you develop a level of comfort with this new system and you can then modify seeding rates to achieve further goals in future years.

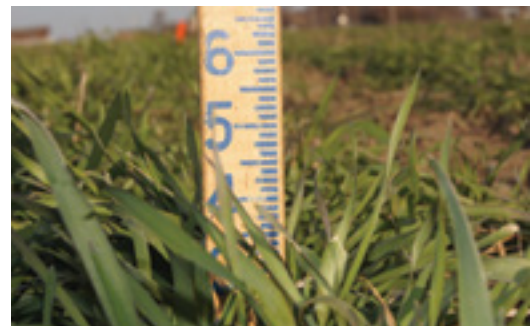
6. **Seed Cost:** Seed cost can vary significantly, so obtaining quotes in the summer from 2-4 reputable suppliers is encouraged. Seed is often available in 56 pound bags and mini-bulks.

7. **Termination Timing and Soybean Planting Date:** Cereal rye should be terminated a minimum of two weeks before anticipated soybean planting date. Err on the side of terminating early vs. too late. Research shows that termination should occur when the plant is 6”-10” in height, before the “boot” (stem elongation) stage. Be aware that with adequate moisture and warm conditions, cereal rye can double in size in 10 days. ***The establishment of soybeans always takes priority over attempting to reach a specific cereal rye growth stage before terminating that crop.***



Cereal rye at boot stage - terminate prior to this stage

8. **Termination Method:** A full labeled rate of glyphosate to actively growing cereal rye has proven to provide excellent control. Late March and very early April applications should not contain any additional herbicide active ingredients. If you intend to plant soybeans within 2-3 weeks of termination, you can include a residual soybean herbicide with the glyphosate application. Always consult your crop adviser to develop a complete, season long herbicide program.



Terminate at this growth stage

9. **Spring Management of Armyworms, Slugs or Other Pests:** Remove the “green bridge.” Pests in cover crops after termination can move to the next crop if there hasn’t been enough time for the cover crop to deteriorate after being terminated. But if cover crop termination occurs a minimum of two weeks prior to soybean planting, pest food source and habitat will disappear. By the time soybeans emerge, pests will have perished. Voles can become noticeable in cover crop/no-till environments. They eat all vegetation around their colony (generally 10’-20’ diameter areas). At the Piatt County research site in 2015, about a dozen colonies were present in a 74 acre soybean field. But predation from coyotes, hawks, and owls has resulted in zero damage since. A resource from the University of Tennessee on controlling voles in no-till soybeans is available here: extension.tennessee.edu/publications/Documents/PB1667.pdf



Avoid planting into a green bridge (above).

10. **Cover Crop Roots Impeding Field Tile:** There have been concerns raised about the roots of cover crops plugging field tiles. This is relatively rare and in most cases has been linked to three reoccurring issues: improper tile grade, improper tile connections, and/or annual ryegrass was the cover crop. *If you have experienced this issue, or know someone who has, please contact Dr. Armstrong, an author of this document, so that we can determine the circumstances surrounding your experience, provide an assessment, and offer solutions.*



Preferred bridge

11. **Soybean Establishment & Tillage Considerations:** How you manage corn stalks in the fall and your soil preparation plays a vital role in determining the best soybean planting method. There are several scenarios that work. Note: If you are selecting a new practice, attention should be given to planter settings to achieve appropriate performance for the respective field conditions. For example, increased residue can influence planting depth and the closing of the seed slot.

Untouched corn stalks- Plan to no-till soybeans in the spring. Well maintained drills, and most modern planters with row cleaners (and sharp disc openers) can be used. Corn residue and decaying cereal rye can be pushed aside or penetrated. Seeding rates may need to be increased slightly, based on equipment performance.

Vertical-tilled corn stalks- Again, most row cleaner equipped planters, or no-till/minimum-till drills can handle this planting environment. If you determine a light spring vertical tillage pass is beneficial, that is at your discretion.



Untouched stalks



Vertical tillage



Fall strips



Strip freshening

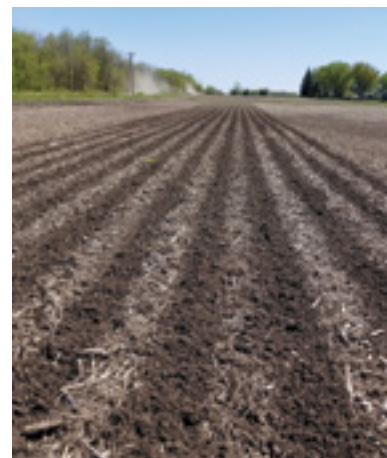
Fall strip-tilled corn stalks- Simply plant into the strips in the spring. Strip-till should be performed only on level, non-highly erodible fields.

Strip freshening- We are conducting research evaluating the use of strip fresheners. This tool features 30” spaced row units that combine a row cleaner, three low disturbance coulters, and a finishing basket to create shallow tilled strips approximately 10” wide. It can be utilized in the fall, spring, or both. Other row widths are also available.

12. **Continue with Your Rotation to Corn:** After soybean harvest, it’s back to corn season. Because reduced tillage systems are very compatible with systems using cover crops, you may want to consider an additional soil conservation practice. If your test field has level to slightly undulating topography, and the soybean residue was spread evenly behind your combine, strip-till is an option.

If applying anhydrous ammonia in the fall, ahead of corn, you can make strips with the ammonia toolbar (wait until soil temp falls to 50 soil degrees), or when deep banding phosphorus fertilizer. Tractors performing field operations should be RTK autosteer equipped. Otherwise, no additional fall tillage following soybean harvest is needed. If winter annuals are a concern, a fall herbicide application may be warranted. In the spring, you can plant directly into the strips if they are mellow, or “scratched” lightly with a strip freshener to create a smooth and consistent seedbed.

A row cleaner on your planter that is set to remove any residue or clods, without throwing soil to the side, is helpful. In this scenario, soil organic matter is conserved and erosion potential is reduced.



Toolbar strips

Other Important Observations:

Economics: The cost of cover crop seed, establishment, and termination can be offset by reducing tillage and saving that equipment and fuel expense. In the very near future, we will have overall economic comparisons from our on-farm research sites. The profitability of systems that include cover crops, compared to fields in the same production system without cover crops, will be evaluated in these NREC funded projects.

Systems Approach: We have observed that the most successful experience with cover crops coincides with strip-till and no-till systems. It is important for everyone to realize that including cover crops in a conventional corn/soybean enterprise takes a “systems” approach to achieve real benefits. When cover crops have failed, it is often due to them being managed only as an additional input, rather than part of a new production system. Modified production techniques for cash crops, as well as management of cover crops, are concepts that need to be embraced to assure success.

Accidental Cover Crops: Volunteer corn and/or fall emerged winter annuals as accidental cover crops sequester minimal nitrogen. For example, a corn plant remains on endosperm reserve until the V3 growth stage and a killing frost often occurs before much soil inorganic N is accumulated. And while spring infestations of weeds like henbit and chickweed can be a nuisance for field cultivator sweeps, their above ground biomass N concentration is only about 1% (if allowed to grow to maturity), which only adds up to about 10 lbs per acre. By comparison, research has shown that cereal rye often accumulates between 30 and 70 lbs of nitrogen per acre.

Fertilizer: There is no need to add any nitrogen to stimulate growth of cover crops. Producers can continue with their normal fall fertility programs. Applications that include DAP or MAP may see a portion of that nitrogen absorbed by the cover crop and released at some point the following year.

Late Season Mineralized Nitrogen: In the past several years, N WATCH soil samples have revealed that soil nitrate levels can rise due to soil mineralization continuing after harvest. In addition, NREC studies across the state have observed elevated nitrate concentrations in tile following rainfall events in November and December. With warm winters becoming more common, NREC studies have demonstrated at multiple sites that a timely, well established cereal rye cover crop can capture mineralized nitrogen after crop harvest, and also into the early spring as soil warms.

Where Does Sequestered Nitrogen Go? This research question is currently being addressed by NREC. At two sites, we are studying how the cover crop plots may affect the carbon/nitrogen storage capacity of the soil over time. In another on-farm NREC site, we are studying cereal rye ahead of corn. At this site we have three termination timings for the cereal rye; we are measuring soil N availability following the terminations and the early response of corn at the V7 growth stage to estimate N release from the cereal rye. At yet another on-farm site, for two years we have been tracking the release of carbon and nitrogen from cereal rye residue following the spring termination, to predict how much nitrogen we can expect to be released back to the soil from a good stand of cereal rye. We believe we will have answers to these questions as NREC research continues.

Why Is All of This Important?

Illinois agriculture has earned the support of all stakeholders and government agencies to utilize voluntary practices to reduce nitrogen losses by 15% and phosphorus losses by 25% by the year 2025. Ultimately, both N and P losses must be reduced by 45% to meet the Goals of the Gulf Hypoxia Action Plan.

The Illinois Nutrient Loss Reduction Strategy (INLRS) has identified cover crops as a method to reduce nutrient losses, but research specific to Illinois soils, climate and crop systems is needed. NREC is working to provide this information for Illinois farmers. With NREC's support, researchers are working to identify practical systems for cover crop management. They are taking the risks so that you don't have to, and identifying what may work best on Illinois fields in our cash grain production ag system. Ultimately, the goal is to determine practical methods that are also economically viable and acceptable, particularly in tile drained areas of the state where nitrogen losses are more prevalent.

For more on the INLRS, go to: www.epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/nutrient-loss-reduction-strategy/index

